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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/020,314	12/18/2001	Yasuhiro Shimamoto	HITA.0143	8410

7590 05/06/2003

REED SMITH HAZEL & THOMAS LLP
Suite 1400
3110 Fairview Park Drive
Falls Church, VA 22042

EXAMINER	
NGUYEN, KHIEM D	
ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 05/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/020,314	Applicant(s) SHIMAMOTO ET AL.
	Examiner Khiem D Nguyen	Art Unit 2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

The restriction in paper no. 7 is withdrawn. Claims 1-20 are pending in this application.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Derderian et al. (U.S. Pub. 2002/0058414) in view of the applicant's admitted prior art of this application (AAPA).

Derderian discloses a fabricating method of a semiconductor integrated circuit comprising forming a ruthenium electrode (top electrode54 and bottom electrode 33) (paragraphs [0079]-[0081]) of a capacitor 37 with high-k material on a semiconductor substrate by a chemical vapor deposition method in a sub-atmospheric pressure using an organoruthenium compound as a precursor, immediately thereafter performing annealing (300° C. to about 900° C.) at not less than a formation temperature of the bottom electrode of ruthenium in an inert atmosphere thereby inhibiting deformation of crystal grains of the bottom electrode of ruthenium in the annealing step during or after capacitor insulator

formation (page 5, paragraphs [0058]-[0059]) which includes (See page 3, paragraph [0034] to page 8, paragraph [0103] and FIGS. 1-3):

a first step of providing the semiconductor substrate in a deposition chamber (page 7, paragraph [0076]);

a second step of supplying the precursor into the deposition chamber to form a ruthenium film with a desired thickness on the heated semiconductor substrate (paragraphs [0076]-[0077]) whereby a diluted precursor of an organoruthenium compound is dissolved in a solvent as the precursor and wherein the ruthenium electrode forming method further includes a step of introducing a balance gas in addition to a carrier gas (He) so as to keep a pressure in the deposition chamber constant through all of the other steps (paragraph [0078]);

a third step of stopping the supply of the precursor and decreasing the temperature of the semiconductor substrate, inherently, once the desired thickness of the Ru electrode is achieved, the precursor is stopped, and the temperature is decreased before removing the device from the chamber; and

supplying of an oxidation gas (O_2) into the deposition chamber only during the precursor-supplying step (paragraph [0076]).

Derderian discloses increasing a temperature of the semiconductor substrate in the chamber up to 100° C. to about 400° C. (page 2, paragraph [0020]) and page 7, paragraph [0076]). Thus, Derderian inherently discloses increasing a temperature of the semiconductor substrate in the chamber up to a desired temperature.

Derderian discloses wherein the organoruthenium compound comprises tricarbonyl (1, 3-cyclohexadilene)Ru, $(C_{11}H_{19}O_2)_2(C_8H_{12})Ru$, or any other suitable ruthenium-containing precursor (paragraph [0043]) but fails to explicitly disclose wherein the organoruthenium compound comprises bis-(ethylcyclopentadienyl)ruthenium $[(Ru(C_2H_5C_5H_4)_2]$ as recited in present claim 10.

AAPA discloses wherein the organoruthenium compound comprises bis-(ethylcyclopentadienyl)ruthenium $[(Ru(C_2H_5C_5H_4)_2]$ (Description of the Related Art on page 3 of this application). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Derderian and AAPA to enable the deposition of the Ru electrode by a CVD process using the organoruthenium compound of Derderian to be formed.

Derderian discloses whereby in the second step, the oxidation gas, an inert gas, and a solvent gas are supplied such that the oxygen partial pressure in the deposition chamber is 0.4 torr (paragraph [0076]) but fails to explicitly disclose that the amount of oxygen adsorption onto the surface of the semiconductor substrate is set to a minimum amount required for de-composing the precursor thereby increasing the amount of oxygen adsorption onto the surface of the semiconductor substrate and shortening a growth time of the electrode as recited in present claims 4-9. However, the disclose process would obtain the recited results because the same materials are treated in the same manner as in the instant invention.

Derderian fails to explicitly disclose wherein an average grain size of the crystal grains of the bottom electrode of ruthenium is 30 nm to 60 nm as recited in present claim 15. However, there is no evidence indicating that the average grain size of the crystal grains of the bottom electrode of ruthenium is critical and it has been held that it is not inventive to discover the optimum or workable size or thickness of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
May 1, 2003